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LONDON, JANUARY 30, 1959

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# The Mining Journal

London, January 30, 1959

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## Illicit Diamond Mining in Sierra Leone

THE problem of illicit mining is one which is encountered, in varying degree, in most diamond producing countries. In Sierra Leone, however, it has reached such proportions as to imperil the whole economic and constitutional future of the country.

Up to the end of 1955 the Sierra Leone Selection Trust held exclusive diamond mining rights over the entire country, but in December of that year the agreement between Sierra Leone Selection Trust and the Sierra Leone Government was amended, at the government's request, to permit African mining in certain areas previously reserved for future operations by the company. In the following year the Alluvial Diamond Mining Ordinance 1956 was passed, making it possible for Africans to mine diamonds legally on their own account. It was hoped that by throwing open large areas in which Africans could participate legally in the industry, the attractions of illicit mining would be lessened. Unfortunately, this expectation has not been realized, one of the chief stumbling blocks being the large number of African immigrants who have entered the Colony from neighbouring territories.

There are now far more men in Kono than can find work, including probably as many as 20,000 who do not belong to the district. When they cannot find work they turn to illicit mining either on their own or in gangs. As inevitably happens in similar circumstances, both the illicit mining and the illegal disposal of diamonds have become highly organized industries. The organizers are men with no respect for the law or for the government. They come from many different places and include British subjects, aliens, and African foreigners.

Since the beginning of November the police have arrested over 500 men for illicit mining and over 2,000 for being in the area without a permit. Gangs ranging from 50 to 400 persons were operating on the richest reserves of the Sierra Leone Selection Trust almost every day and night in November and December. They were well organized and directed and it has been difficult for the police to catch up with them. Some gangs are organized like police riot units and send in front a line of slingsmen with stones and a second rank of men with cutlasses or knives. Pistols have been seen but not used. These men attack posts guarding the reserves and during the last two months have sometimes overwhelmed them by force of numbers. If the police attempt to make arrests the gangsters protect the diggers and cover their getaway.

In December, last year, attacks on police posts became more frequent. On three occasions police used tear smoke and on three occasions they opened fire in self-defence. On Christmas Eve a police officer was severely wounded in the hand by a digger with a cutlass. Police had to fire eight rounds and one miner was hit in the shoulder. A gangster arrested recently at night was found to be carrying a pistol. Gangsterism of this kind is extremely serious



and can lead easily and quickly to terrorism. From this aspect alone, illicit mining has become a challenge which cannot be ignored, but there is another and no less compelling reason for the government's determination to take whatever measures may be necessary to stamp it out.

Besides being well organized into gang operations, illicit mining is directed at Sierra Leone Selection Trust's richest reserve areas. In the past, serious damage has been done to outlying areas, but what is happening now affects the company's raw materials for the next two or three years. The government believes that, if this were allowed to continue unchecked for six months, the very existence of the company would be imperilled because illicit mining would have taken so much of the best that what was left would not be worth working.

A statement issued on behalf of the government points out that the Sierra Leone Selection Trust is mining under agreements made in good faith and approved by the legislature, and emphasizes the government's intention to stand by these agreements.

The statement also makes it clear that, apart from the fact that no government could permit its authority to be flouted, the suppression of illicit mining is of critical importance to the country's future prosperity. In the first place, it is essential that investment from overseas should be safeguarded or investors will look elsewhere. Secondly, the company will pay in revenue £800,000 during the current year and £1,000,000 in 1960. For a time it could be the largest revenue earner in Sierra Leone. If, through the ravages of illicit mining, the activities of this company were brought to an end or were so reduced in profitability that they ceased to yield tax, real hardship would be caused both to Kono and to the whole country. Since it would not be possible to replace this amount of revenue from any other source, financial independence would be imperilled and at the worst possible time. A final consideration is that the company pays wages amounting each year to nearly £500,000, apart from food subsidies for African staff worth nearly £100,000, and buys other goods worth more than £250,000. This could all be lost.

The statement concludes by reiterating the government's determination to call a halt to this situation by dealing not only with those who engage in illicit mining but also with those who organize it and profit from it. As an immediate step, the government is insistent that the control of strangers in Kono, through the provisions of Chiefdom Orders, should be tightened. New orders have been made and came into force on January 15. Under these Orders only a limited number of residential permits will be granted and all those who are unsuccessful in obtaining such a permit will have to leave the area.

The government also intends to call a special meeting of the legislature as soon as possible to put before it other changes in the Diamond Industry Protection Legislation to enable it to deal firmly with the situation.

In view of the geographical situation of Sierra Leone and to the physical difficulties of controlling this large African territory, it is evident that the elimination of illicit mining and the restoration of respect for law and order will be no easy task. The most reassuring factor, of course, is the government's avowed determination to take whatever measures may be necessary to uphold its agreement with the company and to restore its own authority. It can scarcely be doubted that the government has the resources to deal drastically and effectively with the situation, but it is also apparent that only by a determined and timely application of these resources can Sierra Leone hope to derive the fullest possible benefit from the great mineral wealth which still lies untapped in the gravels of her streams and rivers.

## ECHOES OF THE RAINIER BLAST

It has been suggested that the A-bomb in mining operations might possibly provide one answer to the depletion of the world's economic mineral deposits. This belief was referred to in an assessment of Operation Rainier, which appeared in *The Mining Journal* of May 23, 1958.

Some months after the news that Operation Rainier had taken place, certain of the doubts quite obviously associated with the employment of nuclear forces in mines were assuaged. It was stressed that intensity of radioactivity decreases by a factor of 10 for every 7-fold increase in time, and that the median lethal dose is about 400 roentgens if administered during a short period. For continuous operation, the U.S. Atomic Energy Commission is reported as considering it safe to absorb 300 milliroentgens, or 0.3 roentgens per week.

From these answers it may be calculated that almost 11 years must elapse for radiation to drop to a level at which mining could be conducted continuously in a hemispherical shell set between 40 ft. and 70 ft. radius from the shot point. Yet U.S. authorities argue that the earth itself is a very effective shield, and that 1 ft. of material will reduce the radiation level by a factor of at least 20. Thus, by controlling the amount of exposed material and by the appropriate use of sandbags, mining can be carried on without undue hazard.

Bearing out this conception, the after-effects of the Rainier explosion are described by Dr. G. W. Johnson in *Engineering and Mining Journal*, Vol. 159, No. 10. Dr. Johnson points out that, "We now have the tunnel completed up to the face of the original spherical cavity produced by the explosion. We are digging pieces of the radioactive material out by hand without any special radiation protection. The radiation levels right against the face are, as expected, about 300 mr. per hr. Standing back 3 ft. from the face the level is 20 mr. An average exposure that one might expect in digging the material out by hand, as we were doing, would average about 50 mr. per hr., which means that a man could work in this position only six hours a week. However, by erecting a simple barrier and using standard mining equipment, the stand-off distances would be such that the radiation levels would be down to background level."

The possibility of further developments in the application of atomic power to mining operations has been discussed with increasing vigour since the Rainier blast, and in our issue of January 16 this year it was pointed out that the U.S. Government had formally offered to sanction the use of atomic explosives for purely commercial purposes. In a mining context, this means a proposal that the A.E.C. experiment with nuclear blasting for the economic extraction of petroleum from rock shale.

While these tentative arrangements were purely of U.S. domestic concern, the possible application of nuclear detonation to oil-winning has now moved further afield. Officials of Richfield Oil Corporation began meetings last Monday with the Canadian Cabinet in Ottawa to discuss the possible use of a nuclear explosion to obtain oil from Richfield's tar-sand lease holdings in the Athabasca area of north-east Alberta. The meetings are aimed at setting up a joint feasibility committee to study the project. The committee would include representatives of the Canadian Government, the U.S. Atomic Energy Commission, and Richfield Corp.

Richfield leases approximately 2,000,000 acres of tar-sands at Athabasca from the Alberta Provincial Government. For two years the corporation has been discussing the possible use of heat, generated by nuclear explosion, to free oil from the Athabasca sands. Tar-sands are solidi-

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fied oil deposits trapped in sand near the surface of the earth.

The Athabasca sands, about 250 miles north-east of Edmonton, and close to the Saskatchewan border, are estimated to hold 300 billion barrels of oil. Richfield Oil Corp., which originally interested the Department of Mines in the idea, made its preliminary investigations on the basis of a good deal of known information.

Many believe that principles used in petroleum refining would be applicable to the effect of a nuclear blast on the oil sands. These are the heat and pressure forces required to separate petrol and various weights of oil from the heavy crude. The result would be to melt the tar-like oil in the sands to a consistency thin enough for it to flow out of the sand and collect in the cavity created by the explosion.

From all accounts, the Richfield Corporation does not believe that the current international discussions on nuclear testing will interfere with the future usage of nuclear explosions in such peaceful pursuits as exploration for oil. It is understood by Richfield that, while the A.E.C. may agree to suspend the testing of nuclear weapons, it is less likely to agree to halt tests for the peaceful employment of atomic power.

### GLASS INDUSTRY FOR ISRAEL ?

The glass industry in Israel should be developed in view of the fact that all the necessary raw materials are available on the spot, according to Professor Leon Vinogradov, of Cracow University, who has recently been sent to Israel as an expert on ceramics and glass by the United Nations Technical Advice Authority.

Within the framework of a detailed survey, it is pointed out that among the raw materials the flint clay, found in Wadi Ramon in the Negev, is the most interesting item.

Extensive investigations, carried out by the Negev Ceramics Co., the Geological Society, and the Israel Mining Industries, indicate the presence of deposits of approximately 100,000 tons of flint clay in the pockets, having an alumina content of 50 to 60 per cent and an iron oxide content of less than 1½ per cent. Eight drillings, made over an area of more than 2,000 km., and an experimental tunnel pit, have demonstrated the presence of approximately 2,000,000 tons of flint clay with an average alumina content of 40 to 50 per cent and an iron content of less than 1½ per cent. In addition, there are (according to Dr. Vinogradov's report) in the 7 m. band about 12,000,000 tons of flint clay with an iron content between 3 and 20 per cent. The Negev Ceramics Co. is at present extracting flint clay from the pockets, both by opencast mining and, by means of a tunnel, in underground mining.

Among many other recommendations, the survey has suggested the commencement of production of iron and aluminium containing compounds from flint clay, using those varieties which are not suitable for ceramic production. In the first stage, aluminium sulphate, alums and aluminium oxide should be produced. Experiments in this direction have been carried out with encouraging results by Fertilisers and Chemicals Ltd., Haifa. If in due course the production of aluminium oxide is started, this may subsequently furnish raw materials for the production of aluminium metal. Quartz sands are found in many areas in the Negev and also in some other parts of the country.

Dr. Vinogradov arrives at the conclusion that on the basis of the sand deposits, as well as on the very pure calcites, dolomites, and feldspar (pegmatite) deposits, a glass industry should be developed, and he makes a number of specific recommendations, for all of which industrial projects a soda plant is necessary. Possibly the sodium

chloride waste liquors, which at present are regarded as noxious waste in the production of potash at the Sodom works and are conducted back into the Dead Sea, might be used for this essential purpose.

### EUROPEAN COAL CRISIS

At a conference of Pool coal producers held earlier this month in Luxembourg, representatives of all sides of the industry asked the European Coal and Steel Community Supreme Council to intervene in the deteriorating coal situation. The Council was asked to approach the governments of the six member countries with suggestions for the creation of import restrictions on fuel. A request for the Council to declare a state of crisis was made by Belgium where some collieries are now working a three-day week.

The situation in Western Germany is not very much better and the Federal Ministry of Trade has been urged by the coal industry to introduce a coal duty of up to 25 marks (41s.) on each ton of imported coal. Certain imports up to 5,000,000 tons would be exempted from this duty, but there is little doubt that if Federal Germany is persuaded to introduce this crippling tax it would sound the death-knell to many contracts still under consideration. Already the Federal Government has agreed that oil produced in Western Germany will, in future, like coal, be subject to a "turn-over" tax.

Later reports point out that on Monday representatives of West German coal producers and international oil companies reached agreement in talks on a coal-oil cartel to ensure that heavy fuel oil is not sold on the West German market under world prices. The agreement provided for an average West German price, which varies on a regional basis, so as to make fuel oil dearer in the Ruhr area and north, and cheaper in the south. The oil companies also agree to refrain from price undercutting, and to cease advertising fuel oil for one year.

The cartel price lists are to be laid before the Economics Ministry within the next few days so that the Ministry can decide whether to approve the cartel or not. It is understood that the agreement on the average West German price is to remain in force for two years.

Representatives from Ruhr industrial concerns recently visited the U.S. to discuss the coal import problem. The current developments could scarcely be expected to be popular in the United States, and on Monday of this week the National Coal Association, in a letter to the Secretary of State, asked the State Department to protest against the new West German tariff on coal imports. It will be recalled that the West Germans approved a tariff on imports of coal from the United States last week after the first 3,500,000 tons had been admitted free. After that coal imports would be taxed at \$4.76 a ton.

The Association's letter declared that: "This arbitrary unilateral action will effectively deprive the United States of about 60 per cent of its largest overseas market for bituminous coal". The letter said that the tariff action would probably limit West German imports of United States coal to the duty-free amount. Last year, West Germany bought 9,500,000 tons of United States coal.

Mr. John L. Lewis, president of the United Mine Workers, has written to the Under-Secretary of State for Economic Affairs, saying that the "hostile action" of West Germany could destroy the jobs of 20,000 U.S. miners. Mr. Pickett, executive vice-president of the N.C.A., and Mr. Lewis asked the State Department to protest officially to the West German Government. Mr. Lewis also suggested that the United States use economic reprisals if the tariff was not lifted.

## INNOVATIONS IN GRAVEL PUMP TREATMENT PLANT—II.

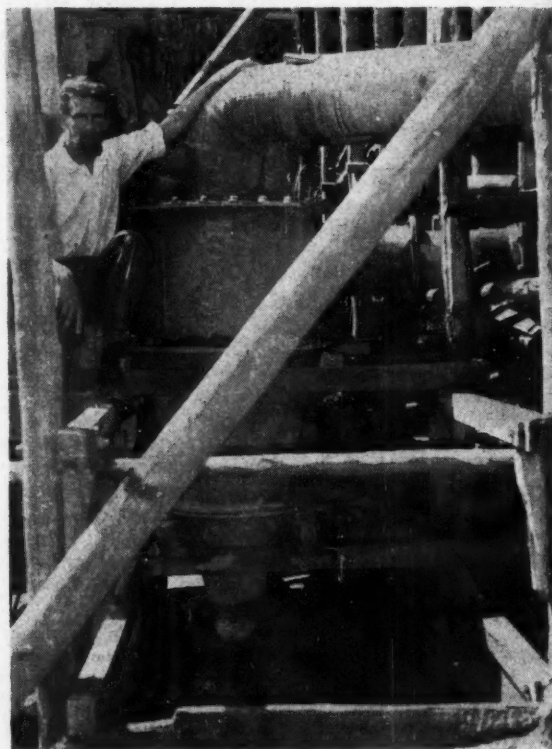
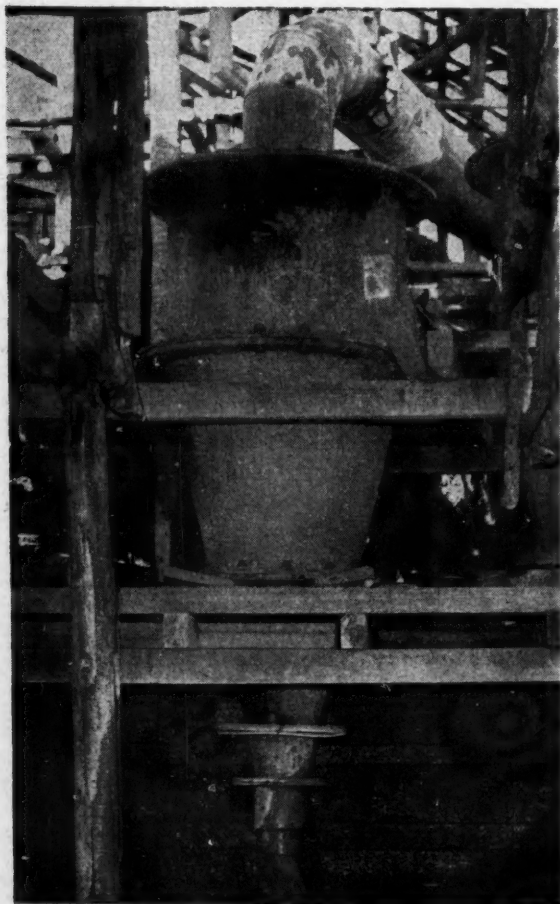
# Tin Treatment Plant in Malaya

THE problem remaining was to de-slime and de-water the resulting  $\frac{3}{4}$  in. feed, which was being delivered at the rate of 3,000 gallons per minute and at a pulp density of 10 to 15 per cent solids. It was decided to attempt this in one stage by means of a large low-pressure hydrocyclone. A 27 in. cyclone was constructed with a 27 deg. cone and a 3 in. underflow spigot, to be operated at a feed pressure of 5 p.s.i.

On trial, first with a pumped feed and later with a gravity feed, taking about a third of the output of the mine, this cyclone showed that the project was feasible. The overflow was substantially all —300 mesh and carried only a small amount of cassiterite of such fineness that its recovery would normally be regarded as impracticable. (The existence of such fine cassiterite had hitherto not even been known, since it had never been recorded by the methods of sampling and valuation in use.) The underflow proved to be an excellent feed for a jig, and, moreover, was found to contain fine cassiterite, down to 300 mesh, which had formerly been lost.

A Yuba jig with two 42 in. cells was available and this was installed to test the cyclone underflow. The jig was found, however, to have a capacity in excess of that of the one cyclone, and the decision was made to turn the whole of the mine output into the experimental plant. Five 30 in.

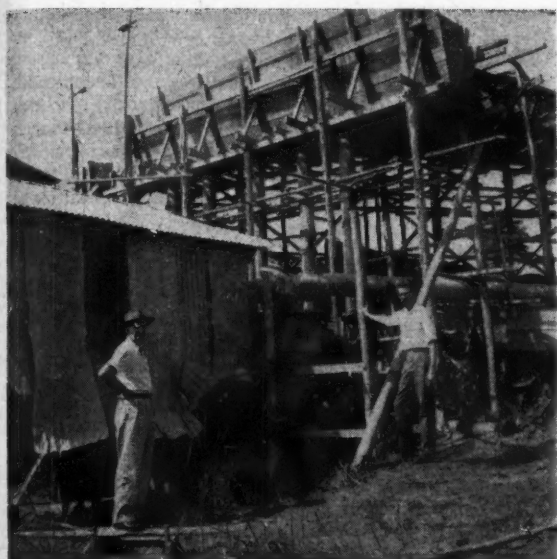
*This article is the second of the series presenting "Innovations in Treatment Plant for Gravel Pump Tin Mines in Malaya", by J. H. Harris, Chief Research Officer, Department of Mines, Federation of Malaya. The article, in its entirety, is published by permission of the Chief Inspector of Mines with the authority of the Minister of Natural Resources of the Federation.*



cyclones were designed, constructed, and installed, operating by gravity with an effective head of  $13\frac{1}{2}$  ft. Of these, three were found sufficient at first. Later modifications reduced the requirement to two. The latest design of 30 in. cyclone evolved by the Research Division handles about 1,500 g.p.m. of feed, with the available head of  $13\frac{1}{2}$  ft. It rejects 1,400 g.p.m. of surplus water and slime, 90 per cent of the solids in the overflow being finer than 300 mesh. The underflow is 100 g.p.m. at 30 per cent solids, only 15 per cent of which is —300 mesh.

Above is the high-capacity development for the Research Division's low-pressure 30-in. hydrocyclone with experimental  $5\frac{1}{2}$ -in. underflow. Alongside, at left, the second cyclone with normal 3-in. underflow. Capacity of these cyclones is 1,500 g.p.m. at 5-6 p.s.i. The feed contains rock up to  $\frac{3}{4}$  in. size. Overflow is —300 mesh





General view of the hydrocyclone plant, showing header box and five gravity feed pipes, two of which are in use

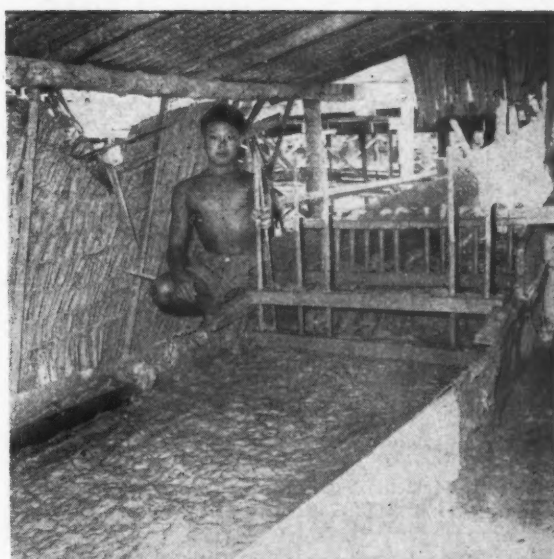
A typical screen analysis of the underflow is as follows:

Through	On	Per cent
1 in. ....	1/2 in. ....	3.0
1/2 in. ....	1/4 in. ....	8.0
1/4 in. ....	10 B.S. ....	11.1
10 B.S. ....	60 B.S. ....	47.7
60 B.S. ....	100 B.S. ....	8.5
100 B.S. ....	200 B.S. ....	3.6
200 B.S. ....	300 B.S. ....	1.5
300 B.S. ....		16.6
		100.0

In another test, the distribution of tin in the cyclone products was found to be:

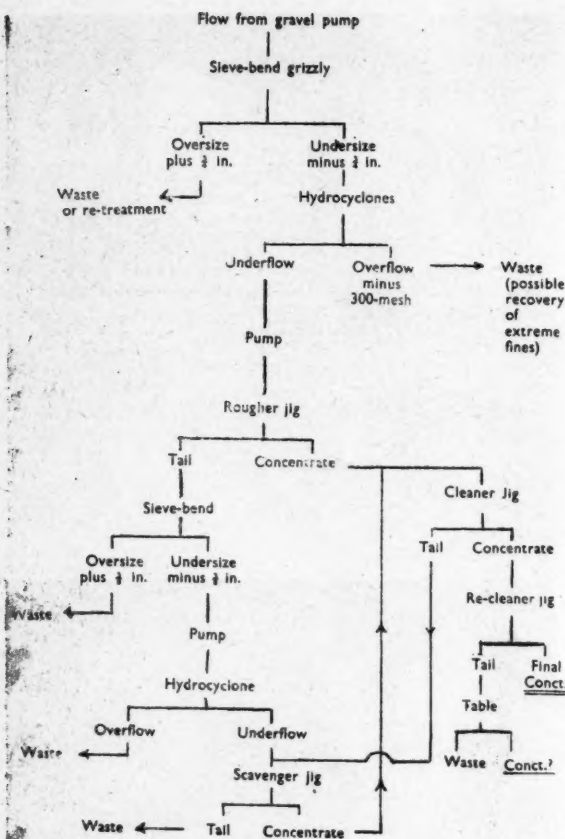
Mesh size		Underflow		Overflow	
Through	On	Wt. per cent of feed	Distribution of tin, %	Wt. per cent of feed	Distribution of tin, %
	85 B.S.	32.2	65.2	0.7	1.1
85 B.S.	100 B.S.	0.3	1.1	0.2	0.9
100 B.S.	150 B.S.	0.9	3.7	1.5	1.8
150 B.S.	200 B.S.	0.5	1.2	1.4	1.0
200 B.S.	240 B.S.	0.3	0.7	1.1	0.6
240 B.S.	300 B.S.	0.3	0.4	1.8	0.7
300 B.S.		7.0	2.1	51.8	19.5
		41.5	74.4	58.5	25.6

The bed formed on the jig by the coarse underflow from the cyclones acted gratifyingly as an efficient trap for cassiterite, while the high density and non-slimy nature of the feed increased the capacity of the jig to a figure far in excess of that expected locally. It was noted that a high recovery could be obtained with this jig, only two cells long, at a feed rate of 25 cu. yds./hr. The jig tailings still carried fine cassiterite, but it was clear that no useful pur-



At right, from top to bottom: top, flow over a Yuba jig taking cyclone underflow at 25 cu. yds. dry solids per hour; centre, observing the hutch product of the Yuba jig; and below, the scavenging operation





pose would be served by extending the jigging process on the same material. Since it would still be necessary to move 1 in. gangue, it could only be expected that fine mineral would continue to move with it into the tailing. The theory was developed that, if coarse gangue were screened off, the residual tailing would be amenable to jigging since the size and mass relation between gangue and remaining mineral would have changed. Furthermore, the screening could be done without loss of oversize free cassiterite since that would already have been caught in the original jigging.

#### Scavenging

This, in fact, proved to be the case. The screening was performed with a second coarse sieve bend which, again radically different from established practice, performed well at a size split of about  $\frac{1}{2}$  in. The undersize was re-jigged on a locally made two-cell 4 ft. by 7 ft. jig with excellent results, which were later improved by the addition of a pump and cyclone to de-water the feed to the jig.

#### Cleaning and Re-cleaning

The rough concentrates from the two jigs were cleaned on a locally made 2 ft. by 7 ft. two-cell jig, and these concentrates re-cleaned with the aid of a Denver jig and a locally made two-cell 14 $\frac{1}{2}$  in. by 36 in. jig. Various re-cleaning circuits were tried and a shaking table was put in to test the tailings. A typical flow sheet is shown above.

At this particular mine the final concentrates were of good grade and could be prepared for shipment with a

minimum amount of final dressing by conventional hand-dressing methods. At other mines the final concentrate would consist of a complex heavy mineral assemblage which would best be treated by flow sheets combining gravity, flotation, magnetic, and electrostatic separation. The Research Division has already pioneered many innovations in this direction, resulting in improved recoveries, in work extending over the past seven years. (*Bulletins 1-4*, Department of Mines, Research Division, Federation of Malaya.)

## Safety in Indian Coal Mines

THE recent explosion at Chinakuri Colliery, near Asansol, the mine fire at Kothagudium Collieries, and the drowning of miners at the Central Bhowrah Colliery, all in India, have focused the attention of the public, the industry, and the Indian Government on the necessity of taking a survey of the safety measures existing in Indian mines.

The Indian coal-mining industry today is producing about 40,000,000 tons of coal per year and employs over 590,000 persons. If the rate of accidents in Indian mines has been low hitherto, it is not owing to any big technical planning or any vigorous campaigns of safety, but is rather due to the good geological conditions, shallow depths, and slow tempo of work obtaining in the country. Out of over 800 mines, 40,000,000 tons a year are produced; whilst Poland, with 100 mines having much similar conditions, produces 95,000,000 tons.

The Indian Mines Regulations appear at once to be inadequate. A few glaring deficiencies are mentioned below.

No standby or reserve main mine mechanical ventilator is prescribed by the regulations. No "ventilation men" are required to be appointed under Indian regulations in gassy mines. No "stone-dust barriers" are required to be erected in mine roads as safeguard against explosions. No fire doors are prescribed by our regulations to be erected near the pit bottom of a down-cast shaft, which can be closed or opened from both sides.

One rescue station is required by the Indian Coal Mines Rescue Rules to be located at Dhanbad for the Jharia coalfield (Bihar), which has an area of 175 square miles, and another at Asansol for the Ranigunj coalfield (Bengal), which has an area of 500 square miles. The rescue rules require that where the total number of persons employed at a mine underground is not more than 500, there shall be employed not less than one trained man, and where the total number of persons employed is more than 500 but less than 1,000, there shall not be less than two trained men to co-operate with the rescue station in rescue work.

In view of the fact that several of the Indian mines are located far away from any towns or railway lines, and sometimes without any other mode of conveyance, it is essential that every mine should maintain a mine rescue brigade of its own, consisting of at least three troops, each troop comprising a leader and four rescue men. Also, there should be a "help plan", prepared by the central rescue station, according to which two or more neighbouring mines belonging to different mining companies mutually help one another in case of serious mine accidents.

As seams at shallow depths are worked out, seams at greater depths will have to be mined. It would be wise to go through the statutory safety requirements that are in force in the various mining industries of Europe.

# Uranium: Surplus or Deficit?

THE object of this article is to assemble some of the information which is available on the uranium industry, statistical and otherwise, and also to describe some of the unknown factors which have to be assessed (guessed might be a better word) if any kind of a view of the industry is to be taken.

## Arbitrary Evaluation of Unknowns Inevitable

It must be made clear at the beginning that no reliable estimate can yet be made of the trend of the demand for uranium. This is partly a result of the uncertainties surrounding such factors as the rate at which different countries will install nuclear generating capacity, the types of reactors they will use, and the success or otherwise likely to attend the efforts of technicians to raise efficiencies and cut costs. It is mainly due, however, to the fact that overwhelmingly the largest outlet for uranium at present is for U.S. defence and other needs.

Even on the supply side there are some uncertainties, mainly because American prospective output has been increased in the last few years by the Ambrosia Lake discoveries and more recently by those at Gas Hills, Wyoming; these have complicated the picture for it now seems uncertain just when supplies from these sources will appear. Thus, it is difficult today to strike a balance and to estimate a surplus or deficit at any future date; the most that can be done is to draw tentative conclusions based on stated suppositions.

## Growth in Uranium Supply Flattening Out

To put this section into proportion, it would be as well to see how large an industry uranium mining has become. In terms of oxide at \$10 a lb. the Free World's 42,000 s.tons per year is worth something like £300,000,000. This puts uranium, for example, after copper and aluminium which at £220 and £180 per ton give values of £660,000,000 for mined copper and £480,000,000 for aluminium. Similar figures for lead, zinc and tin are £142,000,000, £187,000,000 and £126,000,000.

In terms of s.tons of oxide, estimated Free World production is approximately as follows:

	World	Canada	U.S.A.	S. Africa	Others
1957 ...	21,920	6,440	8,640	5,640	1,200
1958 ...	36,100	13,000	15,000	6,000	2,100
1959 ...	42,500	16,000	17,500	6,200	2,800
1960 ...	43,900	16,000	18,700	6,200	3,000
1961 ...	45,400	16,000	20,000	6,200	3,200

There is a good deal of estimation in these figures (though the Union's is the limit agreed with the Combined Development Agency) as some tonnages refer to end-of-year rates and others to mid-year rates. They do, however, give an idea of the order of magnitude.

It is believed that the Ambrosia Lake mines in America will be late in reaching scheduled production so that the full weight of U.S. production may not be felt for perhaps two years, later than is than in the world table above. For the purpose of this article, however, Free World production may be taken as 42,000 s.tons per year today and reaching a maximum of 45,400 in 1961.

Present government contracts absorb all this production for the next few years. In Canada, the U.S. Government's contracts with the Canadian Government through Eldorado last until 1962 to 1963 when further options may be taken up until 1966. South African contracts with the

It has, for some time, been apparent that the critical period for the uranium mining industry would come after the conclusion, in the mid-1960's, of the numerous government contracts which have made possible the phenomenally rapid growth of this industry, as well as its capital amortization. What is likely to be the balance of supply and demand in 1965, and how rapidly is civilian demand likely to expand thereafter? In setting out to examine the probabilities in this admittedly uncertain future, this article, which is also appearing in *The Mining Journal Quarterly Review of South African Gold Shares*, presents data and reaches conclusions with which the majority of the Commonwealth uranium producers are believed to be in substantial agreement.

Joint Board run until 1964 to 1966 and similar contracts have been arranged for U.S. domestic production. These are mentioned only in passing since the object of this article is to weigh up the real demand for uranium and not the actual contracts. The ending of the contracts merely highlights the problem.

Table I shows the various national estimates by governments or by other authorities of future nuclear generating capacity. In some cases the early years are based on reactors actually building or planned for particular dates while for later years it is assumed that the programme grows at a fixed compound interest rate between the dates for which estimates are given.

On the whole, the more ambitious estimates have been discarded in favour of the more conservative. A number of technical assumptions have been made and these are given below. Some of these are arbitrary and this is freely admitted; the important thing is that they should be stated.

TABLE I—FORECAST OF INSTALLED NUCLEAR GENERATING CAPACITY IN MWe

	1965	1970	1975
United Kingdom ...	5,000	12,000	25,000
Other O.E.E.C. ...	5,000	11,000	25,000
Canada ...	500	1,000	2,500
U.S.A. ...	1,500	5,000	17,000
Australia and New Zealand ...	350	600	1,000
South America ...	600	1,200	2,500
Japan ...	600	3,000	7,050
India ...	1,000	1,250	1,800

### Sources:

National Programmes as outlined at Second Geneva Conference.

U.N. Report on Economic Applications of Atomic Energy.

O.E.E.C. Electricity Supply, 1957-75 (assuming one-third of original Euratom "target" by 1965).

National Planning Association of the U.S.A.; Productive Uses of Nuclear Energy.

Table II represents the expression of the expanding nuclear generating programmes in terms of prospective requirements for natural uranium metal. Calculations of fuel requirements are expressed throughout this article in tonnes (metric tons) of natural uranium metal. One s.ton of  $U_3O_8$  (uranium oxide) has been taken as 0.77 tonnes of uranium metal.

TABLE II—FORECAST OF ANNUAL DEMAND FOR INITIAL AND REFUELLING CHARGES IN TONNES OF NATURAL URANIUM

	1965	1970	1975
United Kingdom ...	4,673	4,600	8,820
Other O.E.E.C. ...	2,179	4,477	10,577
Canada ...	170	430	1,100
Australia and New Zealand ...	98	179	308
South America ...	212	430	935
Japan ...	492	1,762	2,937
India ...	400	400	400
TOTAL ...	8,224	12,278	25,077
U.S.A. ...	793	2,675	8,500



No account in this article is taken of process heat in industry, which can be expected one day to become an important use for uranium but is largely ruled out at present owing to cost and the problem of continuity. Fusion also is disregarded as a competitor since it is not believed that this could be a significant source of power before 1980.

#### Assumptions Underlying Demand Estimates

First of all, it is assumed that the improved Calder Hall type of gas-cooled reactor will be built in the U.K. until 1966 and thereafter the advanced gas-cooled reactor (A.G.R.) using enriched fuel.

In the case of the Calder Hall type a rating of 0.6 MWe per metric ton (or tonne) has been assumed. This governs the initial charge required and it has been assumed that the effective demand for this initial charge will be operative one year before the reactor comes into operation to allow for processing the uranium and fabricating the fuel elements. The annual refuelling charge is taken as 20 per cent (20 per cent of each year's total installed capacity but available for use as it were in the following year).

With the A.G.R. the initial charge has been based on a rating of 1.0 MWe per tonne, effective two years in advance; this is to allow also for producing the enriched material. Similarly, the annual refuelling charge is reckoned at 15 per cent, one year in advance.

These assumptions for the A.G.R. are applied also to programmes in other countries involving enriched fuel reactors. Thus, the A.G.R. is regarded as typical of the trend towards low-enrichment reactors which will be coming into use after about 1965. More advanced reactors than these (e.g., the high-temperature gas-cooled (H.T.G.C.) fast breeders and other reactors which will use higher enrichment or pure fissile materials) are left out of the calculation on the ground that their ratings are at present theoretical and they are unlikely to alter the picture radically before the 1970's.

#### Relationship of Efficiency to Costs

This also applies to the use of plutonium, as a fuel as well as a means of enrichment, on the ground that the technical problems to be solved make it at best uncertain that it will be widely used before this date; moreover even if it is, it still requires uranium to produce it. It is true that there may be economies in doing this (though plutonium is no longer regarded in the nature of a by-product) but it is far too early to assess them. To put it another way, the theoretical efficiency with which uranium is used is limited by the cost of the method employed and it does not appear that we are at present on the threshold of a major technical advance which would revolutionize the position before 1975. Advances will be made but they are likely to be gradual.

An exception to this supposition was made in the case of India where the programme presented at Geneva involves the use of plutonium and thereafter a breeder cycle using thorium. This was accepted to avoid departing from a programme designed to use indigenous materials (thorium and some uranium); it would not have affected the total figures much to have redrawn it on uniform lines.

A fuel utilization figure of 3,000 MW. days per tonne of natural uranium has been assumed from 1960 onwards; this governs the refuelling rate in both reactor types. In the case of O.E.E.C. countries other than the U.K., enriched fuel reactors have been assumed to account for one-third of installed capacity up to 1967 and thereafter for all

subsequent additions. In the case of all other countries where programmes will have started rather later than in Europe or where American influence is stronger, the whole programme has been assumed to be of enriched reactors.

#### U.S. Offtake is Decisive

On these assumptions, any of which might be varied, the annual demand for both initial and refuelling charges for the Free World, less the U.S.A., appears to total about 8,000 tonnes of uranium for 1965, 12,000 for 1970 and 25,000 for 1975 (see Table II).

On top of this, allowance must be made for the demand for all purposes from the U.S.A. This is much the largest item and has been stated before a Joint Congressional Committee to be a minimum of 35,735 s.tons of oxide or 27,500 tonnes of metal per year from 1960 onwards. It is believed that most of this, possibly around 20,000 tonnes, goes to the three enormous gaseous diffusion plants and is then used mainly for defence purposes but partly also for the civilian reactor programme which is negligible until about 1970.

Demand for the latter is harder to estimate than for any other country's programme at this early stage and has been subject to the widest variation of guesses. An estimate based on the National Planning Association's assessment is shown separately on the table.

In addition, some uranium in enriched form may find its way into the programmes of other countries and to that extent the estimates may be subject to some double-counting. Some of the natural uranium (probably about 5,000 tonnes) also goes to the plutonium-producing reactors at Hanford and Savannah River.

The only remaining item to mention is the small intake for our own gaseous diffusion plant at Capenhurst which is probably of the order of 1,000 tonnes per annum.

#### Supply-Demand Picture in 1965

In reaching any tentative conclusions from the foregoing we must assume that the statement of the U.S. Joint Committee is not revised—and this possibility would appear to depend largely on the international political situation which looks like continuing as a stalemate at present. We then have a demand for uranium metal in 1965 of the following order:—

U.S.A. . . . .	27,500 tonnes
Other Free World . . . .	8,200
U.K. defence . . . . .	1,000
	<hr/>
	36,700
	<hr/>

This is equivalent to 47,700 s.tons of oxide which compares with a prospective annual supply of about 45,400 for 1961-5.

The next point is to emphasize that this is the *annual* rate of expected demand. The figure for the U.K. is about 1,500 tonnes higher than the years either side of 1965 owing to the last round of the Calder Hall type coinciding or overlapping with the advance demand for the first of the A.G.R. type. This alone, however, is not large enough to invalidate our tentative conclusion.

What is more important is the fact that even if there is a balance in 1965 there will be a surplus of uranium in the years before that date; in other words, the cumulative position by 1965 has to be reckoned with. It should be pointed



out that it is equally true on these calculations that there could be a deficiency of supply *after* 1965. This may point to some stockpiling in the earlier period for use in the later. There is evidence of a plan of this sort in the Joint Congressional Committee's hearings referred to above, although no rumour that anything of the kind has yet been started.

#### What About the U.S.A.?

The third point is to see if anything can be said about the crucial 35,735 s.tons of oxide, or 27,500 tonnes of natural uranium, of the U.S. programme. How long will it continue?

Of the military demand one can only say that it seems to be increasing rather than falling off at present. It is known that the number of U.S. plutonium-producing reactors at Hanford and Savannah River has been increased in the last twelve months; they now number thirteen (with one under construction) and probably take, as mentioned, about 5,000 tonnes per year.

Apart from this there is the naval programme. The U.S.A. plans to build 100 nuclear-powered submarines in its present programme, apart from two carriers, one cruiser and one frigate, which will be prototypes. Of the submarines, five are at sea, three more about to start trials and thirteen more under construction. Building is probably going on at the rate of about twenty per year, which alone probably means something of the order of 300 to 400 tonnes of equivalent natural uranium per year in initial charges. This is only a beginning; the rate of submarine building may well increase if the programme is extended further, and it is not difficult to conceive of the demand from this source and from the building of surface warships reaching 1,000 tonnes per year without considering refuelling charges. Apart from this there is the cargo liner "Savannah", under construction in the U.S.A., and also submarines, freighters, tankers and ice-breakers being planned in many countries which could produce an important new demand from, say, 1970 onwards.

#### Conclusion

In conclusion, these tentative findings suggest that the prospect of excess supplies between now and 1965 may be depressing current views of the outlook for the uranium industry to an unreasonable extent—a natural reaction from the over-optimism of the early days. This, however, is not to minimize the impact of this excess but only to put it in some perspective.

Taking the U.S. Atomic Energy Commission figures of requirements as given to the Joint Committee and adding our estimates for all civil reactors outside the U.S.A. plus a constant 1,000 tonnes per year for the U.K. gaseous diffusion plant, we find that during the period 1959-64 inclusive, an excess supply of about 20,000 s.tons of oxide may be expected to build up. This is rather less than six months' supply at the rate expected in 1964 which is assumed to be the same as the 1961 figure of 45,400 s.tons. On the same basis, and also assuming that the A.E.C. figure continues after 1965, this surplus would be absorbed by 1970 as demand continues to rise.

These tentative estimates assume that the A.E.C. figure covers all U.S. military, naval and civil requirements. If, on the other hand, we take a figure of 20,000 tonnes of metal for U.S. military and naval needs and attempt to assess civil requirements separately, there is still a balance of supply and demand in 1965 but a rather larger cumulative excess up to that year, although one that is still less than a year's supply at that date. Such an excess, however, would still be absorbed by no later than 1970, which once more

suggests the possibility of American stockpiling in the earlier years.

#### Prices

In conclusion, a few remarks may be made about prices. Some speculation has taken place on this subject, much of it ill-informed, but it is clear that, as with other commodities, the Free World will have to pay whatever price is required to bring forth the amount of uranium it needs. If a surplus emerges for a year or two, no doubt the price will fall. It would, however, be a mistake to think that an era of greatly reduced prices is ahead of us, as in the early days of the mining of other metals.

Uranium, as in so many other respects, is probably an exception in this. The mining of it did not start up in a small way as a high-cost operation but emerged suddenly as a full-blown industry. It may be that government contracts allowed favourable depreciation rates to many of the Canadian and S. African mines but these advantages were offset, and in some cases more than offset, by the extra cost which the remarkable speed of construction involved. After the amortization and the redemption of the initial loans has been completed, effective costs will, of course, be lower; perhaps to the extent of \$2-\$3 per lb.

Any fall in price to a still lower level, to distress levels in effect, could involve the risk of closure; this seems unlikely when it is recalled that the Canadian and South African producers started up these new industries at the express and urgent request of the U.S. Government (and, indeed, of the U.K. Government), and that they now account for 5 per cent and 14 per cent respectively of the export trade of Canada and South Africa (excluding gold). The U.S. Government would, therefore, appear to have a clear moral obligation to these two developing countries.

## The Kiruna Ore Line

**B**Y introducing more powerful locomotives in combination with improved ore wagons, the capacity of the Swedish Arctic ore line between Kiruna, in Sweden, and the supply port of Narvik, in Norway, at present 13,000,000 tons of ore per annum, will be raised to 15,000,000 to 20,000,000 tons. Such a capacity is probably unique for a single-track line, particularly when the difficult topographical and climatic conditions prevailing in the region are considered.

The Swedish State Railways recently ordered a number of specially powerful locomotives from ASEA in order to increase the transportation capacity and rationalize operations on the ore line. Each locomotive will consist of three tractive units and will have an effect of 8,600 h.p., which can be raised temporarily to 11,500 h.p. for forcing steep gradients. The maximum tractive power at starting is 75 tons. Mechanical parts will be made by Svenska Järnvägsverkstadsnerna (ASJ), Motala Verkstad and Nohab.

Having a length of 35 m. (115 ft.) and a weight of 270 tons, the new locomotive is a development of the State Railways' ASEA-built Dm locomotives, which have been in operation since 1953 and have so far been the most powerful in Europe. The increased power has been attained by inserting a third tractive unit between the two identical halves of the Dm locomotive, thus raising the tractive capacity by 50 per cent, or from a load of 3,100 tons to over 4,500 tons.



A fleet of Michigan models 85A for the Water Affairs Department, South Africa, being loaded into the "City of Durban"

More than thirty Michigan tractor shovels are being shipped to South Africa this month. Amongst these is the first consignment of a fleet of Michigan models 85A for the Water Affairs Department, South Africa. The 85A machine is designed to operate over rough terrain and has travel speeds up to 26 m.p.h.

The Nyasaland Government, assisted financially by the Colonial Development Corporation, is to carry out a special investigation into mineral resources with a view to encouraging their development by private enterprise.

South Africans will be among the engineers coming to London in July for the three-day symposium on shaft-sinking and tunnelling to be held concurrently with the mining machinery exhibition at Olympia. South African papers will deal with gold mining. A British expert will talk about the recent sinking of a mine

**The imposing premises of the new Mines' School at Jos, in Northern Nigeria, which also houses an ore-cleansing mill**



## MINING MISCELLANY

further \$5,500,000 will be required to place the property into production.

A government proposal to the Storting advised the extension of the previous State guarantee of 9,000,000 kr. to the Spitzbergen Coal Co., Norway, for another three years, and also State guarantee for an investment loan of up to 11,000,000 kr. for the further extension of production. Western Germany agreed to import 100,000 tons of Spitzbergen coal in 1959.

Nickel and cobalt ore reserves in Dutch New Guinea are estimated at between 100,000,000 and 200,000,000 tons by the Dutch Overseas Affairs Minister, Mr. G. P. Helder. The Minister stated that there was great foreign interest in the exploitation of these reserves. The government was now waiting for a decision by some large enterprises who were considering a venture together with Dutch capital. He said geological exploration in the area had also disclosed the presence of chrome and iron ore.

German engineers have shown keen interest in the exploration of mineral ores in Pakistan. A three-man delegation headed by the West German Minister for Economic Affairs, Professor Erhard, visited Pakistan to make a general survey.

Non-sacrificial lead alloy anodes for impressed current cathodization have been approved by Lloyd's of London for the protection of ships' hulls against corrosion, according to an article in the latest issue of *Lead*, quarterly publication of the Lead Industries Association. The results of actual sea trials on a Royal Canadian Navy destroyer, reported by the Naval Research Establishment, Nova Scotia, show that lead alloy anodes, 98 per cent lead, 2 per cent silver, are superior to either graphite, steel, platinum, or magnesium on both economic and technological grounds.

A mining company is now prospecting for barytes in Benue Province, Northern Nigeria. The exploration is a result of the discovery of the mineral two years ago by a company prospecting for oil. The mining company uses about 400 tons of imported barytes a month at present when drilling for oil, but the company feels it would be a good commercial proposition and an opening for further industry in Northern Nigeria if good-quality ground barytes could be locally mined.

Very thin layers of soil containing uranium were discovered at a depth of 100 to 125 ft. this month in the province of Overijssel, Holland.

A mining school has been opened in Northern Nigeria. The school, which is situated in the tin mining centre at Jos, includes an ore cleansing mill. The new establishment will serve three major functions. The first is to give instruction to persons already engaged in the mining industry. Those who successfully pass

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out of the school can become managers, having had experience in the use of ore dressing machinery. At the same time, the Mines Department will send its own technical officers for instruction as part of the training scheme. Secondly, the school will give mines operators, particularly the smaller ones with inadequate machinery, the facility of using the mill. The third function is to carry out experiments on new ore to find out the best way of screening it up to commercial grade. The school buildings and machinery cost £23,000.

A New Zealand company, the Brighton Uranium Prospecting Co., is to carry out fairly extensive prospecting work on their uranium-bearing holding in the Bullock Creek area, between Westport and Punaikaiki, on the South Island's west coast. The concern, comprising Westport interests, has a warrant to prospect 6,000 acres of land. It is understood large quantities of high standard uranium have been revealed there. The New Zealand Mines Department has co-operated with the company in its initial investigations. There has been little more heard of likely developments in the Buller Gorge area of the west coast. It is, however, confidently expected that large-scale prospecting will begin in the near future.

Barclays Bank D.C.O. reports that British Titan Products is surrendering its rutile interests in Sierra Leone to the Consolidated Zinc Corporation, which has wide experience of mining for rutile in other parts of the world and which has a substantial shareholding in British Titan. For some time British Titan has been operating in Sierra Leone jointly with an American firm, Columbia Southern Chemicals Inc., states the Bank, and discussions on the terms of future exploration and mining of rutile are being held. The Minister of Lands and Mines is expected to make a statement on the situation soon.

An outstanding achievement in the North of Scotland Hydro-Electric Board's programme has been confirmed by an announcement that the driving of the network of tunnels in the Killin (Perthshire) section of the Breadalbane scheme has been completed. Work began on this section on April 1, 1957, and the driving of the tunnels was completed nine months ahead of the board's schedule. To do this, progress was maintained at rates which, it is believed, have created new precedents in the hydro-electric field. By using a helicopter, the main contractors, the Mitchell Construction Co. Ltd., speeded up surveying sufficiently to allow tunnelling to start on June 1, 1957, since when over 3,500,000 ft. of blast holes have been drilled and over 1,000,000 lb. of explosives used in excavating 14½ miles of tunnels. The speed of tunnel driving attained on this work has been over ¼ mile per month, equal to the same company's achievement on the St. Fillan's section of the scheme, where it set up a world record of 557 ft. driven in one week on one heading.

On February 3, when he visits the small village of Durgapur in West Bengal, the Duke of Edinburgh will see the progress of Britain's largest export order. This is the Durgapur steelworks, which is being built for the Government of India by a consortium known as the Indian Steelworks Construction Co. Ltd. (ISCON), formed for the purpose by thirteen British companies. This steel-



works, scheduled for completion in 1961, has been specially sponsored by the British Government through the Colombo Plan. Facilities will also be provided through the plan for the training of Indian staff in Britain. On completion, the Durgapur Steelworks will have the capacity to produce 1,000,000 ingot tons of steel annually, as well as 360,000 tons of pig iron and 790,000 tons of railway wheels and axles. Stage 1, when the first blast furnace and the first battery coke ovens are due to reach production, is scheduled for completion by the end of October.

#### PERSONAL

The board of the British South Africa Co. announces that Sir Charles Cumings, K.B.E., has tendered his resignation as a director and as the company's principal representative in Africa, to take effect at July 31, 1959. The Rt. Hon. the Viscount Malvern will assume the appointment as resident director of the company in a non-executive capacity; and the administration will be carried on by Mr. E. S. Newson and Mr. R. H. C. Boys, as joint general managers. The foregoing changes will take effect as at August 1, 1959.

Mr. Donald Woodroffe Thomas, who was a director of Tronoh Mines Ltd., Southern Tronoh Tin Dredging Ltd., Ayer Hitam Tin Dredging Ltd., and Sungai Besi Mines Ltd., and chairman of Gopeng Consolidated Ltd., Pengkalen Ltd., Tekka Ltd., Rambutan Ltd., and Tehidy Minerals Ltd., died on January 20 last.

Mr. T. A. Rogers has been elected president of the Institution of Mining Engineers for 1959-60 in succession to Mr. H. A. Longden.

The following awards, 1957-58, have been notified by the Institution of Mining Engineers: *Douglas Hay Medal* to Dr. H. L. Willet in recognition of his valuable contributions towards the prevention and control of spontaneous combustion in mines; *Maskell Peace Scholarship* of £70 to Mr. John Barry Purcell; *Laurence Holland Medal* and prize of £35 for the Associate Membership Examination in

A panoramic view of construction work at the Durgapur Steel Project, West Bengal, showing coke oven batteries, blast furnace, power plant, cooling tower scheduled for completion before the end of this year

November, 1957, to Mr. Frank Fairclough, as well as £20 to Mr. John Michael Stocks for the examination in May, 1958; *Sam Mavor Students' Prize* to Mr. Alan Smee for his paper entitled "Experiences with the Armstrong Air-breaker at Bank Hall Colliery" (*Trans. Inst. Min. Engrs.*, 1957-58, 117, 170).

Mr. R. C. Leach has been appointed Adviser to the Government of the Union of Burma, Ministry of Mines. Until his retirement on June last from the Burma Corporation (1951), Mr. Leach had been for many years a director, general manager, and then chairman of the corporation.

Mr. A. Johnston, A.M.I.Mech.E., A.M.I.Prod.E., general manager of Martin, Black and Co. (Wire Ropes) Ltd., Coatbridge, near Glasgow, has been appointed to the executive board of the company.

The North British Rubber Co., of Edinburgh and Dumfries, have elected Mr. R. D. Hunt a director, effective on January 1, and have appointed him deputy managing director, assuming full responsibility for sales and marketing.

Mr. G. N. Blades, A.M.E.M.E., has been appointed regional manager, London, of British Insulated Callender's Cables Ltd., in succession to Mr. E. A. Sayers, who retired on December 31, 1958.

Mr. R. R. Kenderdine, M.I.Prod.E., has been elected a director of Crompton Parkinson Ltd. with effect from January 1, 1959. He has also been appointed a managing director.

Mr. K. D. Morgan has joined the staff of Head Wrightson and Co. Ltd. as a sales representative for Iron and Steel Castings and Forgings.



## Machinery and Equipment

### New Survey Instrument

The latest product of the Zeiss range of more than 4,000 optical and scientific instruments is the tacheometer theodolite Theo 030, presented as being suited to any surveying work permitting a mean error of up to  $\pm 15$  cc. or  $\pm 5$  in. respectively, once a stretch is measured in both telescopic positions. The chief fields of application are traversing on surface and underground, subsidiary triangulations, laying-out work, precision and topographic tacheometry.

The instrument is of self-contained construction, all sensitive parts being protected from dust, moisture and abrasive injury. Designed for speedy manipulation, the stud of the Theo 030 has the same diameter as the studs of the manufacturer's optical plummets, target sets, setting-up arrangements for Dimesse staves, etc., so that these parts and the Theo 030 can be interchanged at will on the tripods.

The instrument achieves an essential improvement in colour correction over previous reduction tacheometers. It has a free objective diameter of 35 mm. and 25 times magnification, with internal focusing and, therefore, an invariable length. The light transmission is increased by about 40 per cent by means of an anti-reflection coating of the optics. The anallatic point lies in the tilting axis so that the addition constant practically equals zero. The Theo 030, provided on either side with an aperture sight for rough sighting, can be reversed over the objective.



Sole agents in the United Kingdom are C. Z. Scientific Instruments Ltd.

#### A BLASTING AGENT

A new explosive, an aqueous slurry of ammonium nitrate and T.N.T., has been introduced in Canada and is now being used for open pit blasting operations in the Knob Lake area.

Invented by Dr. M. A. Cook, of the University of Utah, and H. E. Farnam, Jr., of the Iron Ore Co. of Canada, it was developed in collaboration with the explosives division of Canadian Industries Ltd.

According to C-I-L, the fluid character of the material enables it to be loaded efficiently in bags or directly into the borehole without a container. Because

Above, at right, is the Theo 030 tacheometer theodolite manufactured by Zeiss. Below, at left, the Blagdon-Durham AP2 air-power operated manually portable sump pump

of its relatively high density (1.4) and good water tolerance, it can be loaded under water and performs effectively under wet conditions. The strength of the slurry explosive is comparable to that of 70 per cent gelatin dynamite, but the slurry is considerably less sensitive and requires a high explosive primer. The preferred primer is a 6-oz. pellet of "Pentolite" which is initiated with an electric blasting cap, or "Primacord" detonating fuse.

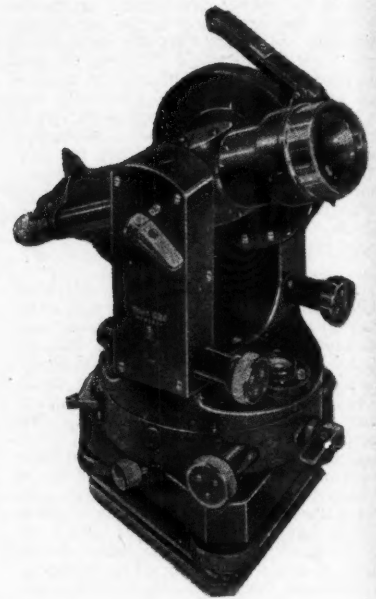
The high strength and efficient loading characteristics are expected to make this explosive especially suited to hard breaking conditions in open pit mines. This belief is supported by the good fragmentation currently being obtained by the Iron Ore Co. of Canada.

#### SUBMERSIBLE CENTRIFUGAL PUMPS

Two new underground mining pumps are announced by Blagdon-Durham Ltd. These pumps, designated Types AP.1 and AP.2, are claimed to be the smallest and lightest air power operated manually portable sump pumps in the world.

Both pumps feature instantaneous starting. The AP.1, only 14 in. high and 8 in. base dia., delivers up to 150 g.p.m. (imperial) at 10 ft. head and up to 50 g.p.m. (imperial) at 50 ft. head, with an air consumption of 40 to 50 c.f.m. The AP.2, only 18 in. high and 8 in. base dia., delivers up to 180 g.p.m. (imperial) at 10 ft. head and up to 50 g.p.m. (imperial) at 70 ft. head, with an air consumption of 70 to 80 c.f.m.

The pumps also have long-life con-



struction incorporating heavy-duty bearings, the elimination of carbon ring sealing providing low torque starting due to freedom from friction drag. Further features typifying the designers' approach include the provision of moisture traps and an exceptionally large reservoir for lubricating oil, indicating the consideration given to the attainment of maximum reliability and minimum wear. Built-in silencers achieve minimum exhaust noise, and the speed governor is totally enclosed yet externally adjustable.

The makers claim that because these two pumps are of simple design and robust construction, they are foolproof and long-lasting. In addition, they have excellent output performance in relation to air consumption.

#### NEW DRAGLINE BUCKET

A 69,000 lb. tri-tapered dragline bucket, claimed by the Electric Steel Foundry Co., United States, to be the largest in the world, has recently been completed. The bucket will be used on a Marion Super 7800. ESCO Alloy 12M and manganese steel castings along with U.S. Steel's T-1 plate are the materials used in the bucket. The tri-tapered design makes it easier to dig large rocks.

Average width of the bucket is 11 ft. 2 in., height from the ground to arch 13 ft. 5 in., and the overall length is 18 ft. 9 in. Two and three-quarter in. wire rope will be used for hoist cable and drag cable will be 3½ in. in diameter. Loaded weight of the unit will be approximately 175,000 lb.

#### OPEN PIT SKIP HAULAGE

A skip haulage system costing more than \$2,000,000 will be completed this year at the open pit copper mine of Kennecott's Chino Mines Division in Santa Rita. The system will include two 40-ton capacity buckets pulled by cables up an inclined track from the bottom to the top of the pit, a vertical distance of approximately 600 ft. The skips will have a hoisting capacity at full drop of about 18,000 t.p.d.

## Metals and Minerals

# Recovery of the Titanium Industry

Better times for titanium metal are predicted in the United States, where a marked upturn in sales has already been noted by producers. These more encouraging predictions coincide with the release by the Bureau of Mines, U.S. Department of the Interior, of its review of the titanium industry in 1958, which, but for the recovery which was already becoming apparent towards the end of the year, would make gloomy reading. Last year was, in fact, the first in the eight-year-old history of titanium metal in which a production advance was not recorded.

Except for a 5 per cent increase in shipments of titanium dioxide pigments over 1957 shipments, all segments of the domestic titanium industry declined markedly in 1958, reports the Bureau of Mines. Production of ilmenite was down 21 per cent to 600,000 s.tons and output of titanium pigments, which uses virtually all the ilmenite, was down 9 per cent on the previous year. Shipments of rutile dropped to 1,700 s.tons, the lowest since 1934. Production of titanium sponge metal for the year was about 4,500 s.tons, or 25 per cent of the peak output in 1957, while consumption fell sharply to less than one-half that of the previous year.

Following the cutback in military requirements for titanium metal in mid-1957, production of titanium sponge dropped to about 10 per cent of the industry's capacity by mid-1958. Towards the end of the year, however, both production and consumption showed an increasing trend. Industry shipments of the metal to users rose in December to about 260 s.tons, compared with 218 tons in November and an average 1958 monthly rate of 210 s.tons.

In his annual survey of the titanium industry Mr. T. W. Lippert, director of marketing, Titanium Corporation, states that in 1958 the market fell into four major categories: commercial aircraft, military aircraft, missiles, and chemicals.

Shipments of titanium metal to builders of commercial aircraft showed a 50 per cent improvement over 1957, demonstrating very markedly that this metal is an economical material of construction—both in the airframe and in the engine.

Sales of titanium in military aircraft rallied last year over those of late 1957, though overall shipments showed a decline. In the area of aircraft two new manned weapon systems are now shifting into higher gear, the Mach 3 (2,100 m.p.h.), B-70 bomber, and F-108 fighter. Barring budget department reverses, these two programmes could have a profound effect on a broad segment of American industry. Two new titanium alloys were developed for these programmes: one being a heat-treatable alloy sheet offering strengths of more than 170,000 lb. per sq. in., and the other an engine material to raise the temperature limits under which titanium can operate effectively.

The usage of titanium metal for missile applications in 1958 was largely in prototype manufacture of liquid-fuelled vehicles. As missiles move into production, titanium metal shipments to this market

will increase correspondingly. Since liquid-fuelled, long-range missiles have been joined by solid-propelled models, the titanium industry is geared product-wise to provide the extremely high strengths required. It was announced in 1958 that a new "all-beta" alloy was available which could be rolled to strengths exceeding by 100,000 lb. sq. in. on a strength-weight basis the nearest competitive material.

The number of chemical customers showed a marked increase in 1958, indicating widespread testing of the material and pointing to the fact that titanium's immediate appearance in the basic chemical field will be confined to replacement of equipment because of corrosion problems, rather than preliminary designs tailored to capitalize on the combination of titanium's properties. In this respect titanium is following a path already travelled in development of the aircraft market.

Based on trends noted in 1958, it would appear that there is an immediate major potential for titanium in the chemical market in areas involving wet chlorine gas, metal chlorines, inorganic chloride salts, and oxidizing organic chlorinations. Other major areas of promise are under investigation. Here again the industry has developed new material grades of special interest to the market. In this case they are softer than alloys required for aircraft.

It is, in fact, significant, as Mr. Lippert points out, that the four markets follow rather closely the development of alloys of cardinal importance to specific and restricted areas of operation.

As to the future, it would appear that producers of titanium metal base their forecasts of increased domestic consumption primarily on rising demand from aircraft and missile manufacturers, though the potentialities of the chemical industry are certainly not being overlooked. It is pointed out that commercial jet engines use considerably more titanium than other aircraft. The Boeing 707, for instance, uses 1,000 lb. of titanium in a single aircraft, the Convair 880 uses 2,500 lb., while the Douglas D.C.-8 likewise uses 2,500 lb. in its airframe, engines and components.

The drive to expand titanium sales will, of course, be very greatly assisted by the further falls in the price of the metal, which has come down from \$5.50 a lb. early in 1958 to the present figure of \$3.50. Even at the latter price titanium metal is three times as costly as stainless steel. Nevertheless, producers believe that the fall in price is one reason for the growing demand.

A development which might conceivably have a bearing on the future economics of the titanium industry is a process for consuming titanium scrap which has just been announced by Thermal Reduction Corporation, of Philadelphia, after four years of research. The limiting factor in the re-use of titanium scrap, apart from melting problems and lack of demand for the metal, has been contamination by foreign alloys, as well as hydrogen, oxygen, and nitrogen, picked up

from the air when the metal is machined. This problem has apparently been overcome. In addition, Thermal Reduction has developed a test for segregating the various grades of titanium scrap generated by the industrial consumer. Mixed grades of titanium scrap have little or no value.

## INCO EXPANDS PRODUCTION

The changing nickel situation is reflected by INCO's announcement that a further step-up in production is to be put into immediate effect. When the company resumed operations on December 26, following the three months' strike, it was stated that production would be commenced at a higher rate than before the strike, and that the intention was to return to a regular 40-hour week from curtailed 32-hour working. The company's Murray mine in the Sudbury district, which closed last July, is being made ready for production. So far, some 14,000 men have been recalled to the Sudbury and Port Colborne plants.

Mr. Ralph D. Parker, vice-president in charge of operations, stated in Toronto that the further increase in production now being put into effect would bring the company's nickel output to an annual rate of approximately 133,000 s.tons—roughly a third higher than the rate of 100,000 tons annually to which output had been reduced before operations were halted by the strike.

The purpose of the increase, as Mr. Parker put it, is to enable the company to restore its customer inventories as well as its own working stocks more quickly than originally planned. In this connection it may be recalled that, at the end of the sixth week of the strike, the company estimated that something over 10,000 s.tons of copper output had been lost since the dispute began. Inco's copper stocks were then reported to be almost exhausted, although nickel stocks were believed to be adequate to carry the company well into 1959.

Meanwhile, the outlook for nickel has been improved by continued recovery of the United States economy, while the prospect of increased copper supplies from Inco's stepped-up operations is particularly timely in view of the low level of world stocks and the labour dispute at Potrerillos.

## NEW USES FOR VANADIUM

Requirements for vanadium compounds as catalysts and in other chemical fields are growing, states a report by H. W. Rathman and H. R. Grady, research engineers with the Vanadium Corporation of America. The use of vanadium pentoxide as a catalyst (for combustion completion) in motor-car exhaust systems or mufflers is now being studied to relieve air pollution in metropolitan areas. Vanadium compounds are reported to be replacing platinum in certain contact processes, notably in sulphuric acid production, with significant reduction in capital costs. Other uses for the compounds are in ceramics,



nylon, paints, inks, and organic chemicals (resins and plastics).

Recently it was reported that ductile vanadium was attracting attention as a new engineering material. The metal was discovered in 1801, but was not produced in pure form until 1927. A semi-commercial process was not developed until 1950. Today, research and development efforts are being extended to widen its potential. Among the properties of ductile vanadium is low neutron cross-section, which has prompted interest in the metal for use in certain reactor applications. Other properties include exceptional corrosion resistance, strength at high temperatures, and good thermal and electrical conductivity.

### THE TRANSISTOR METALS

Continued progress of the transistor metals during 1958 is indicated by the Bureau of Mines, U.S. Department of the Interior, in its surveys of the year.

The germanium industry in the United States in 1958 kept pace with 1957. A record 70,000 lb. of the element were consumed in manufacturing semi-conductor devices. The three domestic producers were the American Zinc Co., of Illinois, Eagle-Picher, and Sylvania Electric Products Inc. Outside the United States, the major germanium producers continued to be the Tsumeb mine in South West Africa and the Prince Leopold mine in

the Belgian Congo. Concentrates from both are processed in Belgium.

The selenium industry in the United States showed a return to a balanced supply-demand pattern in 1958 after a decade first of scarcity and later of over-production. A sharp drop in production was responsible for reversing the trend and resulted in shipments exceeding production by a substantial margin. No new major developments in technology or production were reported, but producers have been intensifying their efforts to find new uses for the element, as the demand for selenium in rectifiers continued to decrease.

High-purity silicon output and consumption again increased in 1958. United States production capacity was increased approximately three-fold. An estimated \$13,000,000 was paid for about 41,000 lb. of high-purity silicon, exclusive of solar-cell grade silicon, consumed in the production of semi-conductor devices. The Bureau estimates that domestic output of high-purity silicon rose last year to 50,000 lb. from 30,000 lb. in 1957, and considers that the 1958 consumption might be doubled during the current year.

The potential use of large quantities of tellurium as a major semi-conductor component in thermo-electronics is forecast, following the introduction of these new devices to the public in 1958.

this year are unlikely to exceed 10,000 tons.

In the United Kingdom, stocks in official warehouses once more show a slight decline at 15,065 tons; as it is certain the majority of this is held by the buffer stock manager, it would not be surprising if a backwarrantation were to develop in the tin market.

The effects of the International Tin Council's steps to limit exports are now becoming apparent in figures being issued, the latest showing that Malaya's tin production in 1958 was the lowest for eleven years, the total being 38,458 l.tons of tin in concentrates against a post-war record figure in 1956 of 62,295 l.tons. On Thursday morning, the Eastern price was equivalent to £792½ per ton c.i.f. Europe.

### FUTURE LEAD-ZINC PRICES IN POLITICIANS' HANDS?

The reduction in the American lead price towards the end of last week to 12 c. per lb. had a very unsettling effect on the market in London, which still shows few signs of recovery, and many people are still talking the price down further. It now appears that to dispose of some of the surplus tonnage of lead in barter deals is going to become very much more difficult—maybe impossible—if the authorities in Washington expect to be able to buy their lead on basis of the L.M.E. quotation.

The zinc market was unsettled by the events in the lead market, but as no reduction in the United States price has yet taken place, some measure of confidence is being restored, and people consider that a further substantial decline is not to be looked for. The downward tendency has been helped by the availability of a fair tonnage of metal for delivery against maturing contracts, and this has had the result of halving the backwarrantation, although there are signs that after the current period has been settled the backwarrantation may return to its previous high level.

Demand for both lead and zinc in the United Kingdom and on the Continent has been of a very routine nature, but in the United States reports indicate that the offtake of zinc is very satisfactory, but in the case of lead, consumers are still holding back. The further outlook for the prices of these two metals appears to lie more in the hands of the politicians than of the producers, and it is disappointing to hear that the meeting which was tentatively fixed to take place in Geneva in February has now been postponed for one or two months.

## COPPER • TIN • LEAD • ZINC

(From Our London Metal Exchange Correspondent)

There have been a number of interesting developments during the past week, but price-wise there has been little change except that copper is appreciably higher and the backwarrantation increased. The general undertone for copper and tin remains favourable, but lead has very few friends, and the majority of people consider that the zinc price is unlikely to move up other than in conformity with a general rising price level of all the metals.

### COPPER GOING UP?

The main interest in the copper market has centred on the emergence of a steadily increasing backwarrantation, and it seems that this is likely to continue for some weeks owing to the technical position of the market and the fact that stocks in official warehouses continue to decline. At the beginning of the week, these stocks amounted to only 4,361 tons, a decrease of 289 tons from the previous week's total. Unless the situation is eased by the recent sales of government copper, it can be foreseen that prices in the United Kingdom will once more have to go to a level which will attract copper from across the Atlantic. As demand in that country is better than it was in the autumn, the rise may have to be considerable.

Meanwhile, in the United States, consumers have been buying more freely, and custom smelters have found it possible to raise their price to 30 c. per lb. At the moment there are no rumours that the producers are considering altering their quotation of 29 c. per lb., at which they report satisfactory business. The Belgian copper price was raised in sympathy with the London market and now stands at

the equivalent of nearly 30 c. per lb., New York or Antwerp.

More general talk is now being heard about the possibilities of labour disturbances during the year, and at the moment the miners at Potrerillos, in Chile, have voted in favour of starting a strike on February 1. It seems as if this is likely to occur, as the demands by the men and the offers by the company are at present very far apart. It is interesting to note that there is a report that the Potrerillos mine will be closed in the near future owing to its low grade of ore, and its place taken by the new El Salvador mine, which is scheduled to produce between 80,000 and 100,000 tons of blister copper a year. Last year, Potrerillos produced 32,935 s.tons of blister copper, Chuquibambilla produced 129,165 s.tons of electrolytic and 84,403 s.tons of blister copper, and El Teniente produced 58,986 s.tons of fire refined and 113,442 s.tons of blister.

### LITTLE CHANGE IN TIN

The tin market has remained relatively idle in spite of the communiqué issued on Monday by the International Tin Council, giving the news that an understanding had been reached between the head of the trade delegation of the U.S.S.R. in the United Kingdom and the chairman of the International Tin Council, whereby the U.S.S.R. agree to limit their exports of tin to 13,500 l.tons during the coming year. In return, the United Kingdom, Netherlands, and Denmark were withdrawing their import restrictions on Russian metal. The announcement had very little effect, as only last week experts were predicting that in any case U.S.S.R. exports of tin during

	Jan. 22		Jan. 29	
	Buyers	Sellers	Buyers	Sellers
COPPER				
Cash ..	£231½	£231½	£240½	£240½
Three months ..	£227½	£228	£235	£235½
Settlement ..	£231½		£240½	
Week's turnover	8,400 tons		10,625 tons	
LEAD				
Current ½ month	£71	£71½	£71	£71½
Three months ..	£71½	£71½	£71½	£71½
Week's turnover	7,500 tons		7,675 tons	
TIN				
Cash ..	£764	£765	£765½	£766
Three months ..	£762	£762½	£765	£765½
Settlement ..	£765		£766	
Week's turnover	520 tons		380 tons	
ZINC				
Current ½ month	£74½	£74½	£73½	£73½
Three months ..	£73	£73½	£72½	£72½
Week's turnover	8,175 tons		10,425 tons	

London Metal and Ore Prices appear on inside back cover.



## Mining Finance

## Anglo Holding Companies Do Well

Increasing dividends from its extensive Orange Free State gold-mining holdings last year put up the net profit of Orange Free State Investment Trust, an Anglo American group company, to £2,682,000, or nearly double the £1,396,319 earned in 1957. The dividend, however, is nowhere near doubled, the final of 2s. 6d. per 10s. share making 4s. against 3s., but the actual distribution is up by proportionately more than the per share figure because there have been two major advances in the issued capital during 1958. One was when the Notes were converted into shares, and the other right at the close of the period, when Anglo American Corporation and De Beers Investment Trust took up their option on 625,000 shares at 80s.

It looks, in fact, as though the Ofsits payment will have taken something in

the neighbourhood of £2,100,000 against only £1,401,839 a year previously when earnings were distributed up to the hilt. On the present occasion £500,000 is being put to reserves despite the new funds of close on £4,500,000 that will have accrued during last year. The balance sheet in the full report due in May should thus present a greatly strengthened appearance with all debts expunged except for the £2,023,183 of Swiss Bonds which are repayable as from the end of 1960.

Ofsits will have capital calls this year from Loraine and Free State Saaiplaas and possibly from Welkom, but should now be in a good position to provide its share. Dividend revenue should also further expand in 1959 and a fresh advance in Ofsits' own payment can be regarded as almost a certainty. The shares have been a good market this week at

85s. ex dividend, partly a reflection of the strong advance in Free State Geduld of which Ofsits should now hold slightly more than 2,000,000. The yield on Ofsits is a modest 4.7 per cent, a reflection of the further growth possibilities and spread of risks that the shares offer in an excitingly speculative field.

West Rand Investment Trust is Ofsits' opposite number in the Far Western Rand and Klerksdorp area gold fields. Here also dividends are expanding from the new mines of these districts and Writ's profit for 1958 after tax rose to £2,636,000 from £1,714,297 in 1957. The final dividend of 2s. 3d., making 3s. 6d. against 3s., did not quite come up to expectations because the company has decided to raise the allocation to reserve from £250,000 to £800,000, a reflection, no doubt, of the new capital raising that is going on in this part of South Africa's gold fields. Writ's will be participating in the current offer of £1 "A" shares at par in Western Deep Levels through its holdings of Blyvoor, West Driefontein, Western Ultra Deep Levels and Witwatersrand Deep. There is also the new issue by West Witwatersrand Areas to be subscribed for.

Writ's 10s. shares stand at 56s. ex dividend to yield 6½ per cent. They are now slightly above the price of 55s. at which the conversion right into Ordinary shares from the £2,040,816 Swiss Bonds is currently exercisable. During 1959 there is thus a chance that this prior charge may be gradually turned into equity capital at a very favourable price so far as Writ's total ultimate capital is concerned.

The third Anglo American group holding company to have declared its dividend and profit for 1958 is Anglo American Investment Trust. This company holds 20 per cent of the De Beers' equity as well as extensive stakes in the diamond trading companies of the group. Its profit for last year is slightly down at £2,828,500 against £3,050,793 in 1957, a reflection, no doubt, of lower income from the trading companies in a year when the diamond turnover, although good, did not come up to the preceding year's record performance. De Beers itself has not changed its distribution for seven years. There are strong hopes that it will see its way to raise the 1958 dividend, but the final due in March will not figure in Anglo Trust's accounts until those for 1959.

Anglo Trust again brings its own distribution up to 100 per cent on the £1 Ordinary shares with a final of 10s. plus a bonus of 2s. 6d. At £11 ex dividend this makes the yield fully 10½ per cent after allowing for double tax relief which is quite an attractive return for a share of this calibre.

## SHADOW OVER "TANKS"

Normally, Captain Charles Waterhouse's speech at the Tanganyika Concessions meeting would have stimulated the 10s. stock units, but these are currently being chiefly swayed by the unfortunate disorders in the Belgian Congo which

## LONDON MARKET HIGHLIGHTS

Strong buying of Free State Geduld from Johannesburg provided the outstanding feature of South African gold shares during the past week. In London, the price of F.S.G. jumped from 126s. 3d. to a highest-ever 135s. 7½d., and as much as £7 was reportedly paid at the Cape. Stimulating the buying were hopes that Thursday's annual meeting of F.S.G. would bring development up to date with news of phenomenal gold values. Some second thoughts on Wednesday brought in profit-takers and the share price fell to 132s. 6d. Thursday's meeting, however, more than confirmed the earlier anticipations. Not only were the development values outstanding (they reached 9,772 in. dwt.), but more important still, they were found south-west of the No. 1 shaft area, which had hitherto been considered as only the "bread and butter" of the mine. F.S.G. shares spurted to over 146s. 3d. on the news, which also enlivened the O.F.S. group as a whole.

Most other gold shares—and copper shares, too—were subjected to a bout of selling from Paris, as holders there switched money from foreign holdings into domestic stocks. There were other firm spots in the O.F.S. group. St. Helena, for instance, came in for a persistent demand which raised the price to a new twelve-year peak of 55s. 3d., Western Holdings advanced to 124s. 4½d., and "Ofsits" reflected the prosperity of the group as a whole by moving up to 85s. 6d. before going ex dividend at 83s. 9d. Hopes also began to circulate regarding the January profits figures due next week, and as a result Winkelhaak (20s. 6d.) and Harmony (41s. 3d.) attracted attention. Blinkpoort (71s. 10½d.) were marked up on their big holding of F.S.G.

On the other hand, Loraine came back to 27s. after the new issue terms, and further selling of "rights" lowered the premium on the new Western Deep proposition to 18s.; both prices rallied later.

Finance stocks also tended to improve with Selection Trust (103s. 1½d.) being helped by news of the sale by American Metal of its Tube Investments shares.

The advance in the metal price was, of course, the dominant factor in copper shares. Already firm at £230 a ton despite the imminent arrivals of Rhodesian metal, the price of copper surprised nobody when it edged up to £240 following news of strike threats at the Chilean Potrerillos mine. If the labour troubles spread to all the Chilean mines, it was realized that current copper prices would look very cheap indeed. There were also those who viewed with concern the coming renewal of the United States copper workers' wage contract in June.

Against this background copper shares soon shrugged off the effects of Paris selling and an uncertain Wall Street. Even "Tanks", which had previously dropped to 47s., recovered to 51s. despite news of a fresh outbreak of rioting in the Belgian Congo. Rhokana strengthened to £29, "Rhoango" to 82s. 6d., and after a flurry of small buying orders Bancroft reached 29s. 3d.

Other base-metal issues failed to produce any startling movements. Tins held firm enough on the more optimistic outlook for the metal price, but apart from some unexplained erratic movements in Consolidated Zinc, lead-zincs were subdued.

Possibly the biggest price movement of the week was in St. John d'El Rey, the shares of which advanced from 80s. to 90s. A small but steady United States demand in a market desperately short of shares was sufficient to account for the movement. Thanks to Brazilian Government assistance, the mine is able to break even on its gold operations, but there were no new developments reported in the iron ore project on which the mine's future depends.

affect "Tanks" because the holding in Union Minière, the big copper and uranium producer of that area, is one of its major interests.

Reading between the lines it seemed that Captain Waterhouse was being not unhelpful that Union Minière will be able to maintain its 1958 dividend at the reduced 1957 rate. If so, then "Tanks" own payment for the year to July 31 next should certainly not be in any jeopardy. For 1957-58 3s. 3d. was paid plus a 6d. tax free bonus out of revenue reserves. As the chairman pointed out the latter was "a process which cannot be repeated", but this does not mean, of course, that "Tanks" might not be able to hold its distribution at, say, 3s. 9d. less tax. All depends, of course, on Union Minière.

This is apart from the fact that the other major interest, the Benguela Railway, did not do so well last year because freight rates are in some cases dependent on the price of the metal carried which was, of course, lower for copper and other metals. There has also been a material fall in the flow of inward traffic to the Belgian Congo. On the brighter side is the development of traffic from Angola, including the transportation of iron ore to Lobito from the Cuima deposits.

As regards Union Minière, Captain Waterhouse said that its copper sales had remained satisfactory in 1958 and the company was able to make substantial reductions in its stocks. So much so that in October production was stepped up to a rate nearly equal to that of 1957. And there has, of course, been a good recovery in the price of the metal.

#### ASHANTI'S BROKEN WINDER

In the December quarterly report of Ashanti Goldfields it is revealed that hoisting in the new Eaton Turner shaft has been temporarily suspended to allow for replacement of sections of the winder drum. This is an eventuality that had been expected. The work, it is stated, should be completed during February and production has not been seriously affected. It will be maintained at "approximately the same level" until the winder is recommissioned. This will lend particular interest to the January return due next week.

Meanwhile, the December quarter profit of £391,621 before tax compares very favourably with the £317,897 for the same period of 1957. Ashanti 4s. shares are 17s. 3d. ex dividend to yield 11½ per cent on the 1957-58 dividend of 2s. excluding the special bonus of 6d. out of tax savings. The Ashanti chairman, Major General Sir Edward L. Spears, is currently out in Ghana. He should have an interesting and perhaps optimistic story to tell in his annual statement.

#### LORAINÉ ISSUE TERMS

The terms of the Loraine Gold Mines' issue are much as expected, namely the offer to holders of 3,072,669 10s. shares at 20s. in the ratio of one for four. The offer is to be made to shareholders registered on February 18 and full details are to be sent out on February 3. At 27s. 9d. this makes the rights per share worth just over 1s. 6d. There seems to be little doubt that the company's circular next month will be able to put a first-class case as to why this £3,000,000 is to be raised earlier than originally estimated.

One of the obvious points is that progress on the combined property, particularly on that of the Riebeeck section, is going on at a faster rate than originally anticipated. According to Johannesburg there is a lot of technical confidence on the part of Anglo-Transvaal about the future working of the complicated reefs in the Riebeeck sections on which the future of the whole undertaking primarily depends. Miners are being moved down from Anglo-Transvaal's dying Rand Leases mine owing to their knowledge of the extraction of steeply dipping reefs.

#### Financial News and Results

**The End of British Guiana Consolidated.**—British Guiana Consolidated Gold is offering its complete plant, buildings and lease area for sale, either as a going concern or individually. An advertisement containing this offer appears on page 130.

**Requisition for Camp Bird Meeting.**—A requisition for an extraordinary general meeting of Camp Bird Ltd. was presented to the board of the company on Monday, January 26, 1959. The meeting has been requisitioned for the purpose of considering a resolution that a shareholders' committee, consisting of Mr. J. C. George, C.B.E., M.P., Mr. H. A. Benson, F.C.A. (a senior partner of Cooper Bros. and Co.), and Mr. H. L. Layton, F.C.A. (a senior partner of Turquand Youngs and Co.), should be appointed to investigate the affairs of the company and its subsidiaries, and to make a report to be circulated among the shareholders.

**Mawchi Change of Name.**—Mawchi Holdings have now received a certificate from the registrar of companies relating to the change of name from Mawchi Mines. The change was approved at the annual meeting a month ago.

**Kaduna Dividend Warning.**—In declaring unchanged interim dividend of 2d. per share for Kaduna Prospectors and for Kaduna Syndicate, the two companies have given a warning regarding the final payments. As a result of output restriction, it is stated, profits in the current year will show a marked reduction when compared with those for 1957, and the reduced profits will be insufficient to cover dividends approaching those paid last year.

#### Publications Received

**The Geology of the Fitzroy Basin, Western Australia.** Published by the Bureau of Mineral Resources of Australia. Bulletin No. 36.

A report of a geological survey, the compilation of which was seriously delayed by the loss of all field records in the disastrous fire of 1953 at offices in Canberra of the Bureau of Mineral Resources, has recently been released. It is contained in Bulletin No. 36, entitled "The Geology of the Fitzroy Basin, Western Australia". The report embodies the results of a comprehensive study of the area, which is part of the Carnine Basin in the north-east corner of Western Australia.

#### Copper Mining's Contributions to African Advancement

The outstanding contributions of the copper industry in Northern Rhodesia to the progress of the Central African Federation require no introduction to readers of *The Mining Journal*. The industry's leaders are noted for their progressive and constructive approach to the economic and social problems of the African continent, with its multiplicity of races and its varied stages of political advancement. This liberal outlook has invariably dominated the lectures and articles of Sir Ronald L. Prain, chairman of the Rhodesian Selection Trust Group of Companies. Some of these lectures and articles have now been published in book form, under the title, *Selected Papers, 1953-57*.

While several papers deal specifically with the Copperbelt of Northern Rhodesia, in which the group's interests are primarily located, others cover a much wider range of subjects, from the history of the world copper industry and the economics of modern mining to the problems of agricultural development in the Federation of Rhodesia and Nyasaland.

Most of these papers have been published or commented upon in previous issues of this journal, but those already familiar with their contents will none the less welcome this collection, which constitutes a valuable work of reference for all who are interested in the copper industry and in the economic and political advancement of Central Africa.

If one paper in particular may be selected for further mention, we commend our readers to that entitled "The Responsibilities of a Mining Industry to the Community", which was one of three lectures given at the Royal School of Mines in November, 1957. It outlines some of the apparently conflicting responsibilities of the mining industry, and emphasizes that there is a vast combination of circumstances, responsibilities, and loyalties to be brought together to a common point which represents the point of the greatest good for the greatest number. It is precisely in this exercise that management today finds its challenge, states the lecturer, and it is in the solution to these problems that enlightened management finds its greatest achievement. To enter the mining management field today, concludes Sir Ronald, is to enter into a field of industrial philosophy and social service which it would be hard to find paralleled in any other industry in the world.

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Sands and slimes tables.  
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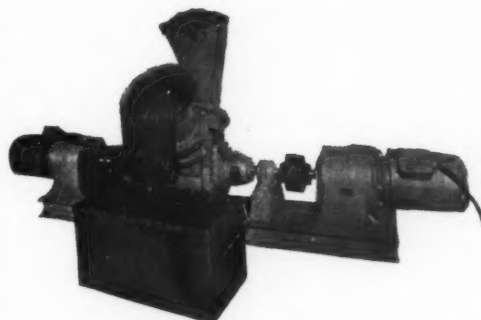
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## TANGANYIKA CONCESSIONS LIMITED

### CAPTAIN CHARLES WATERHOUSE'S REVIEW

#### A REFLECTION OF AFRICAN ECONOMIC CONDITIONS

The Annual General Meeting of Tanganyika Concessions Limited was held on January 22, 1959, at the Head Office of the Company, Tanganyika House, Salisbury, Southern Rhodesia, **Captain the Right Honourable Charles Waterhouse, M.C., D.L.**, the Chairman, presiding.

The Chairman addressed the Meeting as follows:

"Since the last Annual General Meeting, Mr. Harry Oppenheimer has accepted an invitation to join the Board. He has been able to attend several Meetings in the last 12 months and his experience and wisdom will be of the greatest value to the Company.

"You will have seen the portrait of Sir Robert Williams at the beginning of the Annual Report, and you will have noticed that last Tuesday, January 20, marked the 60th Anniversary of the foundation of this Company. We may therefore feel that this Meeting commemorates its Diamond Jubilee.

#### Profit and Dividend

"The financial year to July 31, 1958, ended with a net profit of £3,446,103 as against £4,309,796 in the previous year. The Board recommends a final dividend of 2s. 3d., making a total of 3s. 9d. for the year on the doubled capital of the Company, as compared with 9s. 6d. last year on the old capital.

"An agreement, after prolonged negotiations with the Inland Revenue authorities, makes it possible to pay 6d. of this year's dividend out of a section of the revenue reserves which had paid United Kingdom Income Tax, bringing a material advantage to Shareholders resident in Great Britain. The total dividend of 3s. 9d., if agreed to, should be considered in its entirety as justified by this year's earnings. It therefore indicates no modification of the Company's dividend policy, but it involves a re-adjustment of the figures in the Balance Sheet within the general heading of 'Revenue Reserves'. This, unhappily, is a process which cannot be repeated.

#### Copper Price

"At our meeting last year, I referred to the sharp fall in the price of copper, which during 1957 averaged £219 per ton. That fall continued in the first months of this year, until in February the low figure of £163 was touched. Since then there has been a marked improvement, though it has unfortunately been followed by a fall from the highest point reached. The average price for 1958 was £198.

"On January 3 this year, the Union Minière paid an interim dividend after taxation of 600 Belgian Francs against 750 francs in 1957. They stated that in so doing they merely reverted to an earlier principle whereby a fixed interim dividend of 600 francs was paid each year, and that the size of the interim dividend should not be taken as an indication of the size of the total distribution; the latter would only be fixed in May, 1959.

"The sales of copper by Union Minière have remained satisfactory in 1958, which has led that Company to make substantial deductions from its stocks. To maintain these at the level required for an efficient organizing of the sales, it was decided in October to come back to a rate of production nearly equal

to that of 1957. We therefore await the Union Minière results for the year ended December 31, 1958, with as much interest as ever.

"As you have heard, some disturbances have taken place recently in the Belgian Congo. They have been limited to Leopoldville, where there is a turbulent group of the Bakongo tribe. The Congo is a vast country and the ethnical and economic problems differ widely from one province to another.

"For some time before this trouble arose, the Belgian Government had been preparing a new programme for the political development of the Congo. This programme, which has now been made known, sets the various stages of the evolution and the conditions to be fulfilled at each stage, the final aim being a continued association between Belgium and the Congo. The need to carry on economic development and to promote public and private enterprise was emphasized.

#### The Benguela Railway Company

"The year 1958 has not been an easy one for the Benguela Railway. Freight rates are in some cases dependent on the price of the metal carried, and the low price of copper and of other metals and ores has therefore resulted in lower freight receipts. Even more important has been a material fall in the flow of traffic inward to the Belgian Congo. On the other hand, internal Angola traffic is developing in the steady but unspectacular way which one would expect in a

healthy agricultural economy. In spite of this and certain compensations from other sources, the net revenue shows a material decline on that for 1957.

"During the year the Company has done its utmost to meet the demand for the transport to Lobito of increasing quantities of iron ore from Cuima deposits, and in the last months of 1958 had worked up the tonnage to over 30,000 tons per month. This considerable achievement on the part of Dr. Pinto Basto and his Board, supported by the highly competent Staff in Africa, will, we hope, receive the full recognition it deserves both from the Angola Government and the Mining Companies in the negotiations which are now taking place in Lisbon between them and the Railway Company concerning the long-term development of this traffic.

"The exploration projects in Northern Rhodesia and in Tanganyika Territory in which, with The Zambesia Exploring Company, we are interested through our associate company, Tanganyika Holdings Limited, are continuing according to plan, but as yet there are no major discoveries of economic value to report.

"You will have noted with satisfaction the conclusion of the merger between The Zambesia Exploring Company Limited and Kentan Gold Areas Limited, from which material benefits should accrue to the Shareholders of both companies.

"On behalf of the Shareholders of Tanks, I am happy again to offer my thanks to the Staffs both of this Company and of its Associates."

The Report and Accounts were adopted, the payment of the final dividend was approved and the retiring Directors were re-elected.

#### BRITISH GUIANA CONSOLIDATED GOLDFIELDS LTD. AND POTARO HYDRO-ELECTRIC CO. LTD.

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#### OFFERS ARE INVITED FOR

The Company's undertaking, including concession rights over 10,000 acres of alluvial gold deposits

OR

Individual items of plant and equipment, etc.

#### ORE RESERVES (estimated as at 31.12.57)

Proved ... 32,787,000 cu. yds. (3.32 Gr./cu. yd.)  
Partly proved ... 18,094,000 cu. yds. (3.28 Gr./cu. yd.)

#### EQUIPMENT

##### 2 DREDGES (YUBA DESIGN)

	No. 1	No. 2
Rated capacity ...	1.5 m. cu. yds. p.a.	2 m. cu. yds. p.a.
Bucket capacity ...	6 cu. ft.	10.5 cu. ft.
Approx. weight ...	800 tons	1,530 tons
Digging depth ...	45 feet	46 feet

##### HYDRO-ELECTRIC INSTALLATION

Two 60 in. vertical shaft, Gilkes-Francis turbines; rated output 1,100 B.H.P., complete with transmission and telephone lines.

##### GENERATING EQUIPMENT

3 British Polar, 2-cycle, heavy-oil engines coupled to 3 ATI International G.E.C. 312 kVa. DSI type generators.

##### GAS PLANT

2 Crossley Premier M4/DOH type gas engines coupled to 2 BTH 350 kVa. alternators generating at 6,000 v.

##### SUITABLE BUILDINGS

All in reasonable repair and with necessary ancillary equipment and considerable quantity of spares. Also miscellaneous plant, equipment, transport and consumable stores.

Details available from Receiver and Manager.

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